

**Independent Science Panel
Technical Memorandum 2002-1
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Instream Flows for Salmon

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Water of sufficient quantity and quality is prerequisite to the recovery and protection of fishes. Water is needed for migration of adults to spawning areas, spawning, egg incubation, emergence of fry, growth of juveniles, and migration of smolts. The importance of stream flows in Washington was apparent this past year when faced with drought conditions, human demands for water, and salmon protected under the Endangered Species Act, the Governor ordered implementation of statewide water conservation measures and subsequently developed a Washington water action-strategy. As the human population of Washington continues to increase, we will place even greater demands on water resources, potentially leading to increases in the frequency of emergency water conservation measures to preserve both public water supplies and to provide sustaining flows in streams for salmon and other fishes. In some cases, over-appropriated streams may become severely dewatered as competing demands for water incrementally reduce natural stream flows to a trickle. Salmon, trout, and char in these streams have little chance for survival during draughts. Moreover, continuing shortages of water to maintain instream flows for fish will constrain future recovery efforts for threatened and endangered species of salmon.

The Independent Science Panel² (ISP) provides scientific oversight and review of the State of Washington's efforts to recover salmon. We have critiqued the Statewide Strategy to Recover Salmon (ISP Report 2000-1) and are advising the State's Monitoring Oversight Committee as they develop a statewide monitoring program for watershed health with a focus on salmon recovery. Both plans contain elements directed toward instream flows for fish. Because instream flow is such a key element, we wish to reemphasize its importance for fish in this memorandum and the importance of scientific analyses that develop quantitative relationships between stream flows and the needs of salmon and other fishes.

Scientific understanding of instream flows has improved in the last 40 years. Ascertaining how much water should be left in streams has been an ongoing effort since the late 1960s when resource managers were faced with questions of resource protection in the face of an ever-dwindling water supply. In general, most early efforts in western United States were focused on defining instream flow minima – or the absolute lowest amount of water that should remain in the stream to protect existing aquatic resources –

¹ Members of the Independent Science Panel include: Drs. Ken Currens (Chair), Dudley Reiser (Vice Chair), Hiram Li, John McIntyre, and Walter Megahan.

² The Independent Science Panel was formed in 1998 by the Salmon Recovery Act (77.85.040 RCW).

with the rest of the water available for out-of-stream use. A minimum flow regime assumes that a single flow is sufficient for the whole life history of the fish, which is not necessarily the case. An analogy would be for humans to be subjected to the minimum environmental conditions (e.g., air quality, water quality and quantity, space) that could keep us alive. Current understanding is that aquatic ecosystems and fish populations require more than just a chronic minimum flow condition. Flow needs will vary by life stage. For example, flow conditions needed to provide spawning habitat and egg incubation may differ from conditions needed for adult migration and juvenile rearing.

Stream flows provide three important functions: (1) They are the medium where fish and other aquatic organisms live and propagate; (2) they provide the forces to create and maintain stream channels and off-channel habitats, riparian communities, instream habitat through distribution of large wood that creates pools, riffles, and spawning areas; and (3) they rejuvenate riparian vegetation on floodplains and recharge water tables, which are important to fish and humans, through flows over banks. Stream flows also help regulate stream temperatures – a critical characteristic of the stream environment that affects how much oxygen fish have, how well they grow, how well they survive environmental challenges, availability of food, and the kinds of other organisms in the stream. All these are critical for survival of fish and maintaining productive habitat.

In natural systems, fish populations evolved under flow conditions provided by the natural hydrograph, including high flows during spring runoff or winter storms, and lower flows during summer months. These populations were also subjected to flow extremes, including those associated with floods and drought. As a result, the flow regime during one year may be favorable for salmonid production, and the next year it may be unfavorable. Thus, salmonid populations can and often do fluctuate partially in response to varying climatic conditions. It is this interannual variability in flow conditions that helps determine the suitability and productivity of streams for salmonids, and at the same time creates and maintains habitat diversity and connectivity.

The natural hydrographs of many of Washington's streams, in contrast, have been altered to some degree by human activities. In some, water is over-appropriated. This means that the number of legally recognized water rights in some streams will at times exceed the average amount of water that exists in the streams without regard for what fish need. It is in over-appropriated streams that salmonid habitat recovery efforts will be especially problematic. In contrast, stream flows that are not limited by potential water withdrawals offer important opportunities to protect water for fish.

Although it is controversial, the wise management of water is essential for humans and fish. Decisions for how much water fish need depend on credible scientific information. Integrating credible scientific information will not only require commitment of resources, but it may also require creative use of Western water rights law. We recommend that technical analyses and studies be conducted to quantify the amounts of water necessary to recover and sustain viable populations of salmon and other fishes. Analyses should be done from a watershed perspective and must consider flows that provide for both the spatial requirements of different life history stages, as well as flows that promote and

maintain ecological and hydrological functions and connectivity to important in-channel habitats and adjoining features. Further studies should strive to not only define the relationships of flow to habitat, but also how the habitat affects the abundance and health of fish, something that has typically been overlooked in most instream flow investigations. Because of the urgency in defining appropriate instream flows under Western water rights law and the complex relationship between stream flows and fish, however, even thorough analyses will leave uncertainties. Conservation science offers two solutions to address these kinds of uncertainties: (1) precautionary approaches, where instream flows are risk-adverse to protect fish while scientific uncertainty is high, and (2) adaptive management, where instream flows are set, the effects on fish monitored, and the instream flows are altered to achieve the desired level of protection. Integrating adaptive management in setting instream flows will require creativity and persistence.

The ISP recognizes that there are opportunities available in Washington to protect flows for fish. For example, the Washington Department of Ecology continues to work with the Washington Department of Fish and Wildlife to evaluate instream flow needs for streams and rivers in the state. These opportunities should not be ignored.